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WINDOW-INTEGRATED ANTENNA IN A VEHICLE

Field Of The Invention

The present invention is directed to a window-integrated antenna in a vehicle.

Background Information

Such a window-integrated antenna in a vehicle is known from European Published Patent Application No. 0 382 895. Antenna structures, which are separated from one another for FM reception and AM reception and are heated separately, are provided in EP 0382895 B1. Each of the structures has a matching and decoupling circuit. The vehicle window may be heated over its entire surface in this implementation; however, optimum reception of the signals in the AM and FM ranges is still possible.

Summary Of The Invention

The FM structures may be utilized as a supply lead to the AM structure. Since the second decoupling and matching circuit is situated downstream from the first decoupling and matching circuit, the power supply of the heating conductors of the AM circuit does not directly access the vehicle's power supply, but rather accesses the power supply for the FM circuit which has already run through the first decoupling and matching structure. Since the first decoupling and matching circuit already suppresses the better part of the interferences present in the power supply, the expense for circuitry, in particular the filter expense, for the second decoupling and matching circuit may be minimized.

By splitting the second decoupling and matching circuit in two, the filter expense per individual unit may be further reduced. This implementation of the assembly is equivalent to an implementation with a non-heated AM structure and is thus very easy to handle during the manufacturing process of the vehicle.

If the second decoupling and matching circuit is situated in a shunt circuit of the first decoupling and matching circuit, it is supplied with a lower direct current than the first

decoupling and matching circuit. This makes it possible to dimension the decoupling means (blocking circuits) of the second decoupling and matching circuit for a lower direct current.

Brief Description Of The Drawings

Fig. 1 shows a block diagram of a vehicle's window-integrated antenna according to the present invention.

Fig. 2 shows an alternative embodiment including a split, second decoupling and matching circuit.

Detailed Description

In Figure 1, which shows a block diagram of the window-integrated antenna in a vehicle including its decoupling and matching means, reference numeral S indicates a vehicle window which is installed in body shell K of the vehicle, the vehicle window being preferably the rear window of a motor vehicle. A first conductor configuration L_{FM} made up of parallel heating conductors H_{FM}, which take up approximately 2/3 of the vehicle window's height, is situated in or on a vehicle window S. At their ends, the heating conductors are connected to one another via connecting conductors V1 and V2. Attached to connecting conductors V1 and V2 are terminals A1, A2 of a first decoupling and matching circuit EA1 whose additional terminals A3 and A4 are connected to the terminals of a direct current source B, which is preferably a vehicle battery. A switch SW is provided between direct current source B and terminal A4. An output 01 of first decoupling and matching circuit EA1 leads to a terminal R_{FM} for FM signals. A second conductor configuration L_{AM}, which is spatially and electrically separated from first conductor configuration L_{FM}, is situated in or on vehicle window S preferably above the first conductor configuration; in the exemplary embodiment, second conductor configuration L_{AM} is made up of two heating conductors H_{AM} which are connected to one another at one end and form a heating loop. Two free ends F of second conductor configuration L_{AM} at one side of rear window S are connected to terminals A5 and A6 of a second decoupling and matching circuit EA2. Two additional terminals A7 and A8 of second decoupling and matching circuit EA2 are connected to the supply leads of first decoupling and matching circuit EA1 to connecting conductors V1 and V2. An output 02 of the second decoupling and matching circuit leads to a terminal A_{AM} for AM signals.

The above-described circuit functions as follows:

Decoupling and matching circuits EA1 and EA2 assigned to conductor configurations L_{FM} and L_{AM} have a structure known to those skilled in the art; see US-A 4 439 771, for example. When switch SW is closed, first conductor configuration L_{FM} receives its heating current I_{FM} from current source B via first decoupling and matching circuit EA1 and second conductor configuration L_{AM} receives its heating current I_{AM} via second decoupling and matching circuit EA2 downstream from first decoupling and matching circuit EA1 and situated in a shunt circuit of the same. On account of the fact alone that second decoupling and matching circuit EA1 is situated in the shunt circuit of first decoupling and matching circuit EA2, direct current I_{AM} for second conductor configuration L_{AM} is substantially lower than heating current I_{FM} for first conductor configuration L_{FM}. This makes it possible to dimension the decoupling means of second decoupling and matching circuit EA2 for the lower heating current. The decoupling means in a known manner ensure that the RF voltages, induced in the conductor configurations, are not shorted via direct current source B. The signals of both the FM range and the AM range are available at terminals A_{AM} and A_{FM} of decoupling and matching circuits EA1 and EA2 for relaying to a car radio, for example.

In an alternative embodiment of the window-integrated antenna in a vehicle, heating conductors H_{AM}, H_{FM} of both conductor configurations L_{FM}, L_{AM} are connected at one end to the frame potential, preferably on the side facing connecting conductor V2.

Figure 2 shows an alternative embodiment of the window-integrated antenna in a vehicle including a split, second decoupling and matching circuit. The two sub-networks/filter structures, blocking circuits in particular, are indicated by EA21 and EA22. In this case, second conductor configuration L_{AM} is made up of one or multiple unfolded printed conductors parallel to printed conductors L_{FM}. Their terminal ends F1, F2, at the sides of rear window S opposite to each other, each lead to a first terminal 5 or 6 of one of sub-networks/filter structures EA21 and EA22, whose second terminals A9 and A10 lead to connecting conductors V1 and V2. For coupling the AM signal, only one of the two filter structures is necessary, in this case EA22 including output terminal 02 and terminal A_{AM}.